Overview of San Francisco Bay Sport Fish Contamination And Response Activities

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San Francisco Bay Interim Advisory and Background

In 1994, the San Francisco Bay Regional Water Quality Control Board (SFRWQCB), in cooperation with other state agencies, conducted a pilot study to measure the levels of chemical contaminants in fish in San Francisco Bay. The board found that chemicals in bay fish exceeded levels of potential concern and showed a need for further study. The chemicals or chemical groups of potential concern were polychlorinated biphenyls (PCBs), mercury, DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane), dieldrin, chlordane, and dioxins/furans.

The Office of Environmental Health Hazard Assessment (OEHHA), which is the state agency that issues sport fish consumption advisories, did a preliminary evaluation of the study data and confirmed the potential health hazard. OEHHA then issued an interim sport fish advisory. The advisory gives guidelines for safe consumption levels of sport fish. Following these guidelines would protect against adverse health effects from these chemicals.

The interim sport fish advisory for San Francisco Bay fish is as follows:

- Adults should limit their consumption of San Francisco Bay sport fish to, at most, two meals per month.
- Adults should not eat any striped bass over 35 inches.
- Women who are pregnant or may become pregnant, or who are breast-feeding, and children under six, should not eat more than one meal per month and, in addition, should not eat any meals of large shark (over 24 inches) or large striped bass (over 27 inches).
- This advisory does not apply to salmon, anchovies, herring, and smelt caught in the bay; other ocean caught sport fish; or commercial fish.

Since this advisory was issued, more has been done to study the chemicals in fish and their sources, to take measures to control the contamination, and to revise the advisory. This overview describes these new studies and activities and is intended to give a broader understanding of the problem of chemical contamination of sport fish in the bay.

Recent Studies and Control Measures

Mercury in San Francisco Bay

Mercury is one of the contaminants of greatest public health concern in the bay. Mercury in the bay has come largely from historic sources, but it also comes from current uses. Since the fish advisory was issued for San Francisco Bay, further studies have been done to better understand the sources of mercury and methods for control.

Mercury in bay sediments comes mainly from historic mining, according to a 1996 study published by the San Francisco Estuary Institute (SFEI). The California Coast Range has one of the world's great geologic deposits of mercury, and this deposit was mined intensively during the Gold Rush era to supply mercury for gold extraction in the Sierra Nevada. The SFEI report concluded that the mercury now in the bay is probably too extensive for "area control" cleanup measures such as dredging. But some "point source" controls, such as capture of mercury in wastewater from dental offices and removal of mercury from the flue gas of incinerators, may be possible.

More recently, staff of SFRWQCB have further assessed mercury inputs in the bay, and in a draft report have proposed a regulatory program for controlling them. They agree that much of the mercury in the bay comes from historic sources or is still coming from abandoned mines through the Sacramento watershed. One of their main conclusions, however, is that the smaller sources of mercury, such as treated wastewater, also have to be regulated. This is important because mercury from these sources can be in a form that is chemically reactive and thus more readily available for conversion into organic methylmercury.

Methylmercury is the main form of mercury found in fish and other wildlife. This organic form of mercury is much more toxic than inorganic mercury found in water and sediments. Many complex factors contribute to the conversion of inorganic to organic methylmercury, but bacteria present in the sediment are mainly responsible.

The regional water board staff report identified different sources of mercury and methylation: wastewater treatment plants and industry, stormwater, mines, and atmospheric deposition (mercury falling from the air). Of these sources, mines and stormwater were ranked highest for pollution control based on cost effectiveness.

The report also discusses the leaching of mercury from exposed mine tailings and abandoned mineshafts. Although much has been done over the past several decades to control mercury coming from the largest mines in the region, remediation of smaller mine sites in California is virtually at a standstill. This situation is a result of a federal law that makes parties or agencies involved in remediation of a mine site potentially liable. Under current federal law, a party who engages in cleaning up some of an environmental hazard can become liable for removing the entire hazard even if that party has had no prior association with the property. The regional board is seeking a change in this law.

Mercury appears to get into stormwater mainly from atmospheric deposition. The report recommends that stormwater dischargers better monitor the mercury in their flows and identify conditions that result in the formation of methylmercury so that permit controls can be implemented.

The SFRWQCB draft report includes many elements for developing a regulatory strategy that is required to meet federal law. Although many efforts to control mercury are already underway, more control is still needed, the report says. A goal is to have the rate of mercury inputs to the bay reduced to less than the mercury outflow rate from the bay. Even so, the report says, it will take several decades for the historical sink of mercury in the bay to be buried in deep sediments or flushed out, and for fish tissue levels to decrease significantly. Given this situation, it appears that advisories for limiting consumption of sport fish from the bay will be needed for many years.

The report, *Development of a Regional Policy and Regulatory Program (TMDL) for Mercury in the San Francisco Bay- Sacramento River Watershed, Draft Staff Report, June 1998,* is listed under the SFRWQCB information sources at the end of this document. The report from SFEI on mercury in the bay, titled *Mercury Effects, Sources, and Control Measures,* is available from SFEI. Their address is listed at the end of this document. A fact sheet that explains mercury in the environment in nontechnical terms is also listed there under U.S. Geological Survey. OEHHA has a fact sheet on health effects of mercury in fish.

Fish contamination monitoring and other studies in the bay

SFRWQCB has undertaken more analysis of fish in the bay for chemical contaminants. A technical advisory committee with representatives from various agencies and industry was formed to plan and oversee additional studies. The fish sampling is being managed by SFEI, and is funded by the Regional Monitoring Program for Trace Substances (RMP). RMP is supported by 77 dischargers such as municipal sanitary sewage districts and large industries including oil refineries. The purpose of continued monitoring is to follow up on the initial pilot study and to track trends over time. A report on results of sampling in 1997 is available from SFEI (see SFEI web site listed at end of this document). Preliminary analysis of the results indicates that several chemicals in addition to mercury remain at levels of concern, and OEHHA will more thoroughly evaluate these data.

Some additional special studies on contamination are underway or planned by SFEI. One includes analyzing the effects on contaminant levels of removing the fish skin. This study is intended to measure how removal of the skin, which eliminates the fat layer that is attached to it, reduces the levels of certain chemicals in the fish. Some chemicals, such as PCBs, are stored in fat. Other studies will measure chemical contaminant concentrations in shellfish sampled in the bay. Because the 1994 pilot study only sampled fish in summer, yet another study will measure chemical levels in white croaker in fall, winter, and spring to assess seasonal variation in contaminants. Fish in the delta will also be sampled under direction of the Central Valley Water Quality Control Board.

In addition, the SFRWQCB and SFEI have contracted with the California Department of Health Services (DHS) to conduct a large study on fish consumption in the San Francisco Bay Area. DHS will survey how much fish people eat, what parts they eat, and how they cook the fish. This will help to identify high-risk population groups to target for education efforts. It will also help in assessing their health risks from consuming fish from the bay. The report on the study results is projected to be available in mid-2000. For more information on these studies, contact SFEI or DHS, as listed at the end of this document.

Dioxin overview

Dioxin in fish tissues in San Francisco Bay has been a focus of much attention partly because dioxin is one of the most potent toxic chemicals known. Local environmental groups and the media have tended to focus on dioxin in bay fish over other contaminants that are an equal or greater problem. This section discusses recent developments that may help put dioxin in perspective. Other efforts to study dioxin and to control releases into the bay are also summarized.

In November 1998, the U.S. Environmental Protection Agency (U.S. EPA), Region IX, announced a proposal to add dioxin-like compounds along with the pesticides DDT, dieldrin, and chlordane to the 303(d) list of pollutants in San Francisco Bay compiled by the State Water Resources Control Board (SWRCB) under a provision of the Clean Water Act. Inclusion of chemicals on this list triggers development of water pollution control plans.

The state had already included PCBs and methylmercury on the 303(d) list because they were the critical contaminants that had caused the issuance of the San Francisco Bay fish consumption advisory. U.S. EPA defined "dioxin-like compounds" as 7 types of dioxin, 10 types of furans (compounds structurally related to dioxins), and 12 types of PCBs. This action was part of U.S. EPA's larger proposal to add 37 more rivers and streams, including 35 Bay Area creeks, to the state water agency's 1998 303(d) list of impaired water bodies (472 statewide). U.S. EPA praised the state for the work it had done, but said it was adding these chemicals to the list for San Francisco Bay in response to comments received. The federal government has final approval of the water pollution listings.

The California Environmental Protection Agency (Cal/EPA) objected to U.S. EPA's proposal to add dioxin and furan compounds to the list as high priority chemicals. Cal/EPA said that the dioxin-like PCBs, which were already included under the PCB listing, contribute more than 90 percent of the potential cancer risk, whereas dioxins and furans may contribute only 2 to 10 percent of the risk (letter from Peter M. Rooney, former Secretary for Cal/EPA, to Felicia Marcus, Regional Administrator, U.S. EPA Region IX, December 3, 1998). Moreover, the letter pointed out that the dioxin levels reported in fish in the San Francisco Bay pilot study, although limited in number of samples, were no higher than the background level calculated by U.S. EPA for fish from North American water bodies with no known point sources of dioxin. Preliminary analysis of 1997 sampling data of bay fish also shows dioxins and furans to be within the range of the national background levels.

The letter noted, "Listing the San Francisco Bay as impaired by dioxins and furans at these levels would imply that many other water bodies across the nation should also be listed. This poses a policy issue as to whether water bodies are impaired if they are within national background levels for chemicals of concern."

The Cal/EPA letter further said that "the state does not concur with U.S. EPA that 1994 dioxin and furan levels would warrant a fish advisory if these were the only chemicals of concern. In terms of reducing public health risks from consuming bay fish, one should place a much higher priority on controlling and reducing levels of PCBs in the bay than for

dioxins/furans. PCBs and methylmercury should receive the highest priority in mitigation and clean-up efforts to better protect the public's health from chemical exposures. We concur with U.S. EPA's comment that 'it is unlikely that there would be a rapid reduction in human health risk following further reductions of dioxin-like compound discharges into the environment.'"

One concern regarding dioxins in San Francisco Bay has been a relative lack of data compared with the more substantial database for other chemicals of concern. Data on dioxins are limited because of the high cost of chemical analysis: it costs about $1,700 per sample of fish tissue to analyze dioxins in comparison to the cost of $145 for mercury and $800 for analyzing a large group of other chemicals including PCBs, organochlorines, DDT, and dieldrin.

A further complication is that the sources and transport of dioxin into San Francisco Bay make it difficult to control as a traditional water contaminant. That is, dioxin comes largely from current mobile sources, such as diesel truck engines, and from historical deposition, and is transported by air (see below for more on local sources). For this reason, Cal/EPA is looking to U.S. EPA to do more study on dioxin sources, and develop pollution control methods for this chemical on a multimedia (that is, air, water, land, etc.) and nationwide basis.

Below is a summary of some other recent studies and actions concerning dioxin.

- The U.S. EPA is close to completing their reassessment of dioxins' health effects, and has released a draft inventory of the nation's major dioxin sources. More information on these topics can be obtained on the Internet at www.epa.gov/ncea/ or www.epa.gov/ncea/dei.htm.
- A 1996 Bay Area Air Quality Management District study estimated that diesel exhaust from cars, trucks, buses, equipment, and trains currently contributes 69 percent of the dioxin released to the air, followed by 16 percent from industrial sources, and 15 percent from residential wood burning. Airborne releases of dioxin in the Bay Area have been greatly reduced from earlier levels due to the closing of many medical waste incinerators and elimination of refuse burning. The report, *Air Emission of Dioxins in the Bay Area,* March 1996, is available by written request to Rochelle Walker, Bay Area Air Quality Management District, 939 Ellis Street, San Francisco, California 94109, (415) 771-4784 or FAX (415) 771-5111.
- As noted above, a major source of dioxin is through air emissions from combustion processes. A portion of these emissions enter the bay by direct deposition and from storm water runoff that carries dioxin deposited on land from current and past emissions. A survey of dioxin in storm water runoff conducted by SFRWQCB confirmed the presence of dioxin in runoff. The survey found similar levels throughout the Bay Area suggesting various air sources. A copy of *Survey of Storm Water Runoff Dioxins in the San Francisco Bay Area,* February 1997, is available by written request to Lila Tang, SFRWQCB (see address listed at the end of the document) or on the board's web site at http://www.rwqcb2.com/dioxins/dioxsr.pdf.
- A 1998 SFRWQCB report estimates that dioxin from wastewater discharges from oil refineries and sewage treatment plants contributes less than five percent of the dioxin

going into the bay. To address this contribution, the board has imposed dioxin limits on those facilities, and has imposed an enforcement order on one refinery (Tosco Avon Refinery) that was violating the limit. Tosco implemented changes that have reduced dioxin levels in its wastewater discharge to comply with the limit. The remaining trace levels in Tosco's discharge appear to be from stormwater runoff. This report, *Dioxin in the Bay Environment---A Review of the Environmental Concerns, Regulatory History, Current Status, and Possible Regulatory Options,* February 1998, is available by written request to Lila Tang at SFRWQCB or on the web site listed at the end of this document.

- Based on a study by the City of Palo Alto's sewage treatment agency, the biggest portion of dioxin in sewage comes from laundry wastewater. Other sources include storm water inflow, toilet paper, and food and human wastes. The city prepared a "dioxin pollution prevention plan" outlining their strategy to address dioxin in sewage. These reports, *Dioxin Source Identification,* September 1997, and *Dioxin Pollution Prevention Plan,* October 1997, are available by written request to Kelly Moran, Regional Water Quality Control Plant**,** City of Palo Alto, 2501 Embarcadero Way, Palo Alto, California 94303.
- Because air emissions are a significant source of dioxin in the bay, SFRWQCB is pursuing a multimedia approach to address dioxin in bay fish tissue. This was one of the options that the board presented at a public hearing in February 1998. More details are available in the February 1998 report mentioned above. The board has approached the Air Resources Board, the Bay Area Air Quality Management Board, Cal/EPA, and U.S. EPA to work with them to develop a strategy for the approach.

U.S. EPA's Persistent, Bioaccumulative Toxic Pollutants (PBTs) strategy

The contaminants of concern found in fish in San Francisco Bay--mercury, dioxins, and PCBs, as well as some other chemicals--fall into a general class of chemicals that U.S. EPA calls PBTs because they share common properties. They are highly toxic, long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem health. They are associated with a range of adverse human health effects, including effects on the nervous system, reproductive and developmental problems, cancer, and genetic impacts. The challenge in reducing risks from PBTs stems from the pollutants' ability to travel long distances, to transfer easily among air, water, and land, and to linger for years in people and the environment.

U.S. EPA has begun a new project committed to protecting children and women of childbearing years from exposure to PBTs, and reducing the concentration of PBTs in the nation's waterways.

To date, U.S. EPA actions to reduce emissions of PBTs have been largely separate regulatory activities aimed at different environmental media (air, water, or land). Under the new strategy, U.S. EPA plans to better coordinate its actions to assure, for example, that regulations removing the pollutant from air do not inadvertently result in transferring the pollution to the land or water. Developing an agencywide strategy enables U.S. EPA to harness all of its tools--voluntary, regulatory, international, enforcement, compliance, and research--and direct them at a set of priority pollutants of common concern to all

U.S. EPA program offices. The first 12 Priority PBT Pollutants from the Canada-United States Binational Toxics Strategy are as follows: aldrin/dieldrin, benzo(a)pyrene, chlordane, DDT, hexachlorobenzene, alkyl-lead, mercury and compounds, mirex, octachlorostyrene, PCBs, dioxins and furans, toxaphene.

Some of the near-term actions that U.S. EPA plans to undertake include:

- *Evaluating fish in U.S. water bodies for PBT contamination*. U.S. EPA 's Office of Water will conduct a study of PBT contamination in fish tissue as an indication of PBT contamination in the nation's water bodies.
- *Preventing the introduction of new PBTs into commercial use that may pose an unreasonable risk to human health and the environment, and requiring testing to confirm a chemical's PBT status.* The Toxic Substances Control Act (TSCA) New Chemicals Federal Register Notice dated October 5, 1998.
- *Encouraging voluntary reductions of priority PBTs in hazardous waste.* U.S. EPA's Office of Solid Waste has challenged industry to voluntarily target priority PBTs found in hazardous waste for waste minimization activities. U.S. EPA has proposed a list of 53 PBTs for this purpose in the draft Resource Conservation and Recovery Act (RCRA) PBT List in the Federal Register Notice dated November 9, 1998.
- *Giving the public information on mercury emissions from utilities.* U.S. EPA will require utilities to conduct coal and emissions sampling for mercury in order to analyze the link between mercury emissions and sources.
- *Increasing the public's right-to-know about local sources of PBT emissions.* U.S. EPA's Toxics Release Inventory (TRI) program issued a proposed rule in late 1998 adding certain PBTs to the Toxics Release Inventory, and lowering reporting thresholds for PBTs already on TRI, so that the public will have access to more information about these pollutants.

For information on ordering documents on this strategy, see the U.S. EPA listing in the information resources at the end of this document.

Nickel reduction

Although nickel is not one of the chemical contaminants found to be of potential health concern in bay sport fish, it has been a significant contaminant in the south bay ecosystem. Efforts to reduce nickel discharge into the bay show how one program has been effective in reducing the influx of a significant pollutant in the bay.

In 1989, SFRWQCB ordered the San Jose/Santa Clara Water Pollution Control Plant to reduce its discharge of copper and nickel by more than 50 percent to protect aquatic organisms in the receiving water, and meet state and federal water quality objectives. The plant, which is operated by the City of San Jose, provides wastewater treatment to 1.2 million residents and 16,000 businesses, including many of the computer and electronics manufacturing companies that make up Silicon Valley.

The city’s Environmental Services Department developed a pollutant control strategy that included a pretreatment program that required industries to implement cost-effective

pollution prevention measures. In addition, the department formed a partnership with four of the largest industrial nickel contributors in the service area. The goal of the partnership was to explore and implement ways of reducing the amount of nickel reaching the plant.

In the first several years following the baseline year of 1993, the nickel partnership companies produced an overall 46 percent reduction in nickel loading. This reduction was during a time of significant production increases (up to 350 percent). The city says that this partnership demonstrated that a collaborative approach toward industrial pollutant reduction worked positively and effectively toward reduction efforts beyond those required by regulatory mandate. Based on this success, the city has developed the Industrial User Academy to expand on this cooperative regulatory approach and make it available to all industrial users on a voluntary basis. (*From Command and Control to Cooperation and Consensus: An Environmental Partnership Model*, Bruinsma D, et al., Environmental Services Department, San Jose, February 1997.) More information on the city's pollution prevention efforts is available in the city's Clean Bay Strategy and South Bay Action Plan status reports, available from the Environmental Services Department, 700 Los Esteros Road, San Jose, California 95134. For information on the Industrial User Academy, contact Cheryl Dayley, in the same department, at (408) 945-3030.

Bay Protection and Toxic Cleanup Program

The Bay Protection and Toxic Cleanup Program (BPTCP) is a program of SWRCB and the regional water quality control boards designed to control pollution of the state's bays and estuaries by establishing a program to identify toxic hot spots and plan for their cleanup. The BPTCP has four major goals: (1) protect existing and future beneficial uses of bay and estuarine waters; (2) identify and characterize toxic hot spots; (3) plan for the prevention and control of further pollution at toxic hot spots; and (4) develop plans for remedial actions of existing toxic hot spots and prevent the creation of new toxic hot spots. The draft final *Regional Toxic Hotspot Cleanup Plan* (December 1988) for the San Francisco Bay region is available on the SWRCB web site listed at the end of this document. Final adoption of the plan is anticipated in spring 1999.

OEHHA and the Department of Fish and Game (DFG) also participated in the program as contractors for certain activities of the program. Specifically, OEHHA provided advice on health-related issues and risk assessment.

A bill to continue toxic investigation and cleanup activities in bays and estuaries has been introduced in the 1999-2000 session, AB 641 (Lempert).

Expanded coastal monitoring

The year 1977 saw the beginning of plans for comprehensive monitoring along the California coast. One aspect was the Coastal Initiative that included former Governor Wilson's October 1997 Executive Order (W-162-97) and related legislation. This included a directive for Cal/EPA to inventory existing coastal and ocean water quality monitoring programs and make recommendations for a comprehensive program for monitoring and reducing water pollution.

The inventory of monitoring programs is posted on the California Coastal Water Quality Monitoring Inventory web site at www.sfei.org/camp. Funding for the inventory and web site were provided under two bills passed in 1997--AB 1429 (Shelley) and AB 1581 (Keeley). Also posted on this site is a report titled *Coastal Water Quality Monitoring: A Strategy for Comprehensive Coast Monitoring in California*. The report recommends a long-term, comprehensive strategy to monitor coastal water quality in California.

About the same time, Cal/EPA decided, partly on the interest developed by the San Francisco Bay pilot study, to expand monitoring of fish along the coast on a comprehensive basis. Until this time, large California coastal studies have been conducted only in southern California and Monterey, but, with the exception of San Francisco Bay, have not been done on an ongoing basis. SWRCB provided $324,000 for DFG to collect and analyze fish for chemical contaminants in 1999, and the regional water quality control boards are directing where to conduct the sampling. OEHHA is providing consultation on the types of fish and other factors that will yield data appropriate for evaluating potential human health hazards, and will analyze the data. In general, the types of fish being sampled are the types that people catch and eat most, and the fish are being collected from beach, pier, and offshore locations where people fish frequently. This monitoring program will be ongoing to understand contamination trends and support guidance on the safety of fish for human consumption.

Continuing Analysis of Health Risks

Progress on developing a regular fish consumption advisory for the bay

The fish consumption advisory for San Francisco Bay issued in December 1994 was an interim advisory based on preliminary analysis of the pilot study data. Since then, OEHHA has been thoroughly assessing the risks of consuming sport fish from the bay in preparation for issuing an expanded advisory.

As an initial step in risk assessment, OEHHA examined the chemical concentrations that were reported in the pilot study, looking at trends by sites and fish species. This analysis provides part of the information on contaminant exposure that is needed for the risk assessment, and will be used to determine how separate consumption advice should be given for different fish species due to species variations in contamination levels.

The current health risk assessment is almost entirely based on data from the 1994 pilot study. Recently, results from the 1997 fish sampling in the bay have been reported (*1997 Annual Report. Regional Monitoring Program for Trace Substances. San Francisco Estuary Institute*. 1999). OEHHA intends to thoroughly evaluate these data as well as other new monitoring data that will become available, and will reevaluate and revise the advisory as necessary once the current risk assessment is completed. Reevaluations will continue periodically as results of new fish sampling are made available.

Another part of exposure assessment for determining risk is estimating the amount of fish that people consume. OEHHA has evaluated scientific surveys of fish consumption rates and has developed recommendations for using estimates of fish consumption to describe sport fishers' exposure to contaminants. Information on consumption rates is contained in a draft OEHHA report entitled, *Consumption of Fish and Shellfish in California and the United States, 1998*. The report has gone through public review and workshop discussion and is now under revision in response to comments received. A draft is available on the OEHHA website at www.oehha.ca.gov/.

OEHHA has been further reviewing the toxicity information on each of the six chemicals of concern that were identified in the pilot study, as well as on selenium and arsenic. The detailed analysis confirms that the greatest health risks come from mercury and PCBs.

Mercury has been a subject of much investigation and discussion in the scientific community. One of the major difficulties has been to determine more precisely the health effects on the fetus, whose nervous system is particularly sensitive to methylmercury. Until recently, scientists have had to rely mainly on data that came from a few severe poisoning episodes such as those that occurred at Minamata Bay in Japan where fish were grossly contaminated from mercury discharged from factories and in Iraq where people ate bread made with seed grain treated with mercury as a pesticide. To try to better determine the effects of lower level exposure to mercury through the diet, two new large-scale studies are being done of populations in the Faeroe and Seychelles islands. These studies, conducted over a period of years, have looked at children whose mothers were exposed to mercury through their diets of fish and/or whale products. The Seychelles researchers say that the population there consumes large amounts of fish containing methylmercury concentrations similar to commercial fish in the United States.

These studies should provide a better understanding of whether adverse health effects may occur associated with prenatal exposure to large amounts of fish in the mothers' diet.

Scientists have been discussing why seemingly different results have been reported for these studies. They are asking questions such as, Were there other contaminants in the diet that could have produced the adverse health effects found in one study? and, Could the differences be because of the different sensitivity of the testing methods used?

U.S. EPA issued an eight-volume report on mercury in 1998 and has recently reaffirmed the use of a recommended "reference value" for determining sport fish consumption advisories. This value was not based on the results of the new studies, however. Some other scientific groups including U.S. Agency for Toxic Substances and Disease Registry (ATSDR) are using the new studies to develop reference values. OEHHA is evaluating the new scientific information and will independently determine what would be the best basis for developing sport fish consumption guidance for California.

Health benefits of eating fish

Fish are an excellent, low-fat source of protein, and scientific evidence suggests that diets containing fish protect against coronary disease. Therefore, OEHHA believes that it is important to keep the problem of chemical contamination in perspective with the nutritional benefits of eating fish.

Concerns have been raised that if people reduce their fish consumption due to contamination concerns, they may substitute lower quality sources of protein that are higher in unhealthy fats. This could result in an increase in their risk of mortality from coronary disease. How can consumers decide which is less risky? At present, it is difficult to measure the relative risks and benefits. Currently, U.S. EPA has funded a contract to study ways to compare potential risks and benefits, but it may still be a few years before enough information is developed to provide comparative guidelines for the public.

OEHHA encourages the inclusion of fish in a nutritious diet. Fishers and their families who follow OEHHA's general advisory and follow specific consumption guidance for certain areas, can enjoy their catch without worrying about potential harm to their health.

Sport fish contamination is a nationwide problem

OEHHA has issued sport fish consumption advisories for other parts of the state. For example, OEHHA has issued advisories for Santa Monica Bay in southern California due to contamination of sport fish by PCBs and DDT. The advisories are published in the California Sport Fishing Regulations booklet and posted on OEHHA's web site.

The extent and degree of chemical contamination in fish in California waters has not yet been well determined. Although California has other programs that sample contaminants in water and fish to monitor water quality trends, data from these programs are not generally adequate for conducting human health evaluations and determining whether fish consumption advisories are needed. Sampling and analysis of chemicals in fish are expensive and are not done routinely. Thus, there probably are other locations, especially in coastal range lakes and watersheds, where fish are also contaminated with mercury or

other chemicals. OEHHA works with local health officials on suspected contamination problems.

Chemical contamination of fish occurs in many parts of the United States and Canada as well. U.S. EPA reports that more than 40 percent of waters in the United States are polluted to the point that advisories for fishing or swimming have been issued. President Clinton cited this on February 19, 1998, in his address when releasing the Clean Water Action Plan (www.epa.gov/cleanwater/). This plan can also be found on the U.S. EPA website at www.epa.gov/OST/fishadvice/ where a database shows sport fish advisories around the nation. The 1996 database, which is available now, shows that waterbodies under advisory represent 15 percent of the nation's total lake acres and 5 percent of the nation's total river miles. In addition, 100 percent of the Great Lakes and their connecting waters and a large portion of the nation's coastal waters are also under an advisory. The report says that advisories in the United States increased for four major contaminants (mercury, PCBs, chlordane, and DDT) over previous years. This expansion in the number of advisories may be more a result of increased monitoring rather than rising chemical levels.

In April 1998, the Natural Resources Defense Council issued a report titled, *Contaminated Catch: The Public Health Threat from Toxics in Fish.* This report reviews and compares state fish consumption advisory programs nationwide, and describes the role of U.S. EPA in giving states guidance on these programs. It describes the federal regulation of commercial fish by the U.S. Food and Drug Administration (FDA), and gives information on the contaminants and health effects of contaminants found in fish. It also gives recommendations for decreasing contaminants and effects.

California is used as a case study of a state program. The report observes that California ranks fourth among all states in the number of days people spend fishing. It notes, however, that unlike many states, California does not have a regular monitoring program for contaminants in fish. While finding that California “uses up-to-date methods to identify risks from contaminated fish,” the report says that “responsibility for contaminants in sport and subsistence caught fish is fragmented” because data on contaminants come from intermittent or one-time studies sponsored by different agencies. The Natural Resource Defense Council (NRDC) makes a general recommendation that states develop a plan "for monitoring of potentially contaminated areas that provides reasonable coverage (in terms of frequency and location) of commonly fished species and contaminants." The addition of comprehensive coastal monitoring, as required by the former governor's executive order mentioned above, is an important move in this direction. California does not, however, have plans or resources at this time for monitoring of inland waters nor a legal mandate for an overall fish consumption advisory program.

NRDC report is available for $14.00 plus shipping from NRDC, 40 West 20th Street, New York, New York 10011. 212-727-4486. For more information see the NRDC web site at http://www.nrdc.org/.

Advice about eating fish bought in stores and restaurants

FDA is responsible at the national level for regulating commercial fish sold in stores and restaurants. In an article titled “Mercury in Fish: Cause for Concern” in FDA Consumer

magazine, September 1994, FDA issued advice to consumers about mercury in fish because it is the most common contaminant found. FDA reported that the top ten commercial seafood species, making up about 80 percent of the seafood market, are all relatively low in mercury and that special consumption advice for these species is unnecessary. These top commercial species include canned tuna (which is composed of smaller species of tuna such as albacore and skipjack), shrimp, pollock, salmon, cod, catfish, clams, flatfish, crabs, and scallops. Some other fish, however, often have high levels of mercury and should be eaten in limited quantities, according to FDA. These fish are shark and swordfish, and certain species of very large tuna, which is typically sold as fresh steaks or sushi.

FDA guidelines for consuming fish with high levels of mercury (identified as shark, swordfish, and some large species of tuna) are:

- For pregnant women or women of childbearing age who may become pregnant—not more than one meal per month.
- For adults (other than pregnant or soon to be pregnant women)—not more than seven ounces per week (about one serving).

FDA also advises the following for fish species with moderate levels of mercury (for example, orange roughy, grouper, and marlin):

- For pregnant women or women of childbearing age who may become pregnant—seven ounces (one serving) per week.
- For adults (other than pregnant or soon to be pregnant women)—up to two meals (14 ounces) per week.

These FDA guidelines are for *average* consumers and *do not take into account additional exposure to mercury from consumption of sport fish*. Therefore, OEHHA cautions that the consumption guidelines provided in the sport fish advisories assume that no other contaminated fish are being eaten. People who are catching fish in areas where advisories have been issued for mercury should consider further limiting their fish consumption if they are also eating commercial fish of the species that fall under FDA advisory.

In the above article, FDA notes that not everyone agrees about what advice to provide consumers, and the different states may have different advisories for fish caught in the same waters. Some states have used FDA action levels for contaminants in commercial fish as guidance for issuing sport fish advisories. U.S. EPA, however, takes the approach that FDA action levels used for the marketplace are inappropriate for sport fish consumption advisories because sport fishers tend to eat much more locally caught sport fish and therefore could have higher exposure to contaminants. In addition, FDA's criteria are not as health protective as U.S. EPA's.

Informing Fishers about the Consumption Advisory

Methods of alerting fishers about fish advisories

When the 1994 fish consumption advisory for San Francisco Bay was issued, OEHHA prepared information on health effects of the chemicals of concern in fish, and with DHS issued a nontechnical report explaining the pilot study and the advisory. OEHHA has also prepared a general advisory brochure in six languages. These publications are available from OEHHA by contacting us at the address given at the back of this publication. OEHHA's sport fish consumption advisories are included in the fishing regulations booklet that is given to fishers when they purchase their fishing license.

The public has also been informed of contamination in bay fish in numerous stories carried in the media. The stories have often noted that there are people catching fish who are ignoring the advisory or not aware of it.

One method of informing the public of the existence of a fish consumption advisory is posting signs. Signs about the San Francisco Bay fish consumption advisory have been posted at the Berkeley and Dumbarton fishing piers, along the San Francisco waterfront, and in shoreline East Bay Regional Parks. Many fishing locations around the bay do not have signs posted, however. Lack of funding, different local sign requirements, and other problems have made posting complicated. There has been no state mandate for sign posting, and the posting has been voluntarily done by local government agencies. During the past, several bills to require posting sport fish advisory signs or evaluations of contaminants in fish have been introduced in the Legislature, and this subject is still under discussion there. In the meantime, OEHHA and DHS have been working with local health officials and local jurisdictions to encourage voluntary posting.

OEHHA and DHS formed the Education and Outreach Task Force on Fish Consumption and Fish Contamination Issues several years ago to consider all ways of informing the public. The task force consists of representatives of state and local government, and organizations such as environmental groups. Some of the activities of the task force and its members have included:

- Explaining the fish advisory to local agencies and public groups. The task force itself has been a way for interested organizations to network together.
- Providing information to the public directly through fairs and events.
- Conducting surveys on angler awareness of the advisory and on fishing and consumption habits in order to evaluate education needs.

The current contact person for the task force is Ian Walker at DHS. He may be reached at the Environmental Health Investigation Branch, 1515 Clay St., Suite 1700, Oakland, California 94612, (510) 622-4500.

Several environmental organizations have been active in education and outreach activities. Save San Francisco Bay Association (“Save the Bay”) has held fish preparation and safe consumption workshops, produced a health education video, and conducted grassroots outreach at piers, community events, libraries, health clinics, and schools. Save the Bay has also used the ethnic media to raise public awareness of the health concern. The Asian

Pacific Environmental Network (APEN) is another group that has also done outreach to particular communities, and conducted a consumption survey that is discussed later.

The Fish Contamination Program (FCP) of U.S. EPA is also becoming more active in public education. Earlier, FCP provided states with advice on how to communicate sport fish advisories to the public in *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume IV, Risk Communication*, March 1995, part of a four-volume series on developing advisories. In 1999, FCP mailed out a letter to health care professionals nationwide to emphasize the need for the public to be informed of the health consequences that can result from consuming contaminated sport fish (i.e., fish caught through recreational or subsistence fishing). This effort is part of the President's *Clean Water Action Plan: Restoring and Protecting America's Water*. Copies of the brochure, *Should I Eat the Fish I Catch?* developed by ATSDR and FCP were attached to the letters to health care providers. The brochure is available in English, Spanish, and Hmong, and may be found on the FCP website (see U.S. EPA listed in information sources at the end of this document). This brochure is very similar to the one developed by OEHHA, *Health Advisory: Catching and Eating Sport Fish in California* (available in six languages), and is designed to provide information to consumers about how to reduce their exposure to the contaminants found in the fish they eat.

FCP is also conducting a study that will provide information on the awareness and effectiveness of advisories. The study, which is national in scope, will use focus group techniques to interview women of childbearing age in states having mercury advisories. The information gained will be used to develop ways of designing and distributing advisories. A draft report is expected during 1999. FCP is also studying the health risks and benefits caused by changes as a result of fish consumption advisories.

Angler awareness of fishing advisory

Several informal surveys have been conducted to learn about the fishing habits of people fishing on public piers around San Francisco Bay and their awareness about the fish advisory, and as previously mentioned, a more in-depth study is underway by DHS. Information from these types of surveys can be useful for understanding how to reach different fishing groups, and how to tailor education programs. Following is a synopsis of the studies that have already been completed.

Save the Bay conducted a survey in 1995 of 228 anglers at central and north bay fishing piers. The survey collected information on angler ethnicity and consumption and fishing habits. The report from this survey indicated that most fishers are male, and suggested that the majority are non-Caucasian (over 70 percent). Asians were the most numerous group (36 percent) among those interviewed. Save the Bay's report, *Fishing for Food in San Francisco Bay: Part II* is available for $3.00 from Save San Francisco Bay Association (see address at the end of this document).

APEN conducted a survey focused on the Laotian community of West Contra Costa County. The survey used a community-based process, in which members of the Laotian community planned and conducted the survey. The interviewers questioned 229 people to determine their seafood consumption patterns and related attitudes. Over 40 percent of the people who were interviewed said they catch their own fish. Other sources of fish

included getting fish from other fishers or from small markets. The report on this survey suggested that fishing practices of respondents were tied to past practices in their homelands and their traditional culture.

APEN reported that more than 75 percent of respondents "always eat" the skin of the fish, 20.5 percent eat the head, and 5.7 percent "always eat" the organs. Soups and stews were the most frequent way of preparing fish, followed by frying, baking, steaming, fish pudding (often made with raw, whole fish), and grilling. APEN stated that "The health advisory's recommendations for methods of cooking fish to lower one's risk of taking in harmful chemicals clearly are at odds with traditional ways of preparing fish and other seafoods."

Approximately 40 percent of respondents in the survey reported having eaten fish from San Francisco Bay at some point. Forty-nine percent of respondents had heard of a health advisory for San Francisco Bay. Of this group, 60 percent recalled what it said, but their recall was not more specific than "pregnant women should not eat large amounts of bay fish," or "Bay fish are not safe to eat."

The report, *A Seafood Consumption Survey of the Laotian Community of West Contra Costa County, California*, March 1998, is available for $10 from APEN.

OEHHA conducted a survey in 1995 that focused mainly on angler awareness of advisories and the effectiveness of signs posted at popular fishing locations. Two-thirds of 520 anglers interviewed on Berkeley Pier were aware of the advisory, mainly from signs posted at the pier. Anglers preferred signs as a way of being informed about advisories, followed by television, newspaper, and radio. The report on the survey included references and discussion of similar surveys done in other areas, and concluded that it is important to use many different communication methods rather than rely only on signs as a way of informing fishers. The OEHHA report, *Angler Survey: Analysis of Sign Effectiveness and Angler Awareness of San Francisco Bay Fish Consumption Advisory, Berkeley California, 1995*, is posted on the OEHHA web site.

How to Get More Information

OEHHA sport fish consumption advisories and health information

OEHHA has a brochure on good fishing practices and other information on chemicals in fish. Contact OEHHA's Pesticides and Environmental Toxicology Section, OEHHA, 1515 Clay St., 16th Floor, Oakland, California 94612, (510) 622-3170, (510) 622-3218 FAX, or visit the web site at www.oehha.ca.gov/ and look under "scientific documents."

California sport fish advisories developed by OEHHA are also published in the California Sport Fishing Regulations booklet, which is available at outlets where fishing licenses are sold.

FDA's consumer advice

FDA's consumer advice can be found at the FDA seafood website at http://vm.cfsan.fda.gov/seafood1.html. FDA also maintains a toll-free consumer Seafood Hotline operated by the Center for Food Safety and Applied Nutrition, in Washington, DC. The hotline offers information to consumers in English and Spanish, 24 hours a day, 7 days a week. Over 20 recorded informational messages are offered, as well as publications that may be mailed or automatically faxed to callers. Information is available on safe seafood purchasing, handling, cooking, and storage, as well as on nutrition, labeling, economic fraud, additives, pesticides, contaminants, and general food safety. Public affairs specialists are available from noon to 4 p.m. Eastern daylight time, Monday through Friday, to answer specific questions. The Seafood Hotline is at 1-800-332-4010.

Other information sources

- Asian Pacific Environmental Network, 310 8th St., Suite 309, Oakland, California 94607, (510) 834-8920.
- California Department of Health Services, Environmental Health Investigation Branch, 1515 Clay St., Suite 1700, Oakland, California 94612, (510) 622-4500. Has information about sign posting and investigates fish contamination at federal Superfund sites.
- Natural Resources Defense Council. Amy D. Kyle, *Contaminated Catch: The Public Health Threat from Toxics in Fish,* April 1998, 164 pp., $14.00 plus shipping, Natural Resource Defense Council, 40 West 20th Street, New York, New York 10011, (212) 727-4486. For more information see the NRDC web site at http://www.nrdc.org/.
- San Francisco Bay Regional Water Quality Control Board, *Contaminant Levels in Fish Tissue from San Francisco Bay, Final Report,* June 1995. *Development of a Regional Policy and Regulatory Program (TMDL) for Mercury in the*

San Francisco Bay- Sacramento River Watershed, Draft 1998. 1515 Clay St., Suite 1400, Oakland, California 94612, (510) 622-2300, web site www.rwqcb2.com.

- San Francisco Estuary Institute, 180 Richmond Field Station, 1325 South 46th St., Richmond, California (510) 231-9539. *1997 Annual Report. Regional Monitoring Program for Trace Substances. San Francisco Estuary Institute.* 1999. Web site www.sfei.org.
- Save San Francisco Bay Association, 1736 Franklin St., 4th floor, Oakland, California 94612, (510) 452-9261, web site www.savesf.bay.org.
- State Water Resources Control Board, 901 P St., Sacramento, California 95814, P.O. Box 100, Sacramento, California 95812, (916) 657-2390, web site www.swrcb.ca.gov/
- University of California, Davis, has a website for information on seafood safety at web site www-seafood.ucdavis.edu.
- U.S. EPA publications are available on the Internet at National Environmental Publications Information Site http://www.epa.gov/clariton/index.html or phone 1-800-490-9198. For copies of U.S. EPA 's Draft PBT Strategy and other related documents, call the Pollution Prevention Information Clearinghouse at (202) 260-1023 or via email or the PBT web site at http://www.epa.gov/pbt. Other U.S. EPA sites of interest are www.epa.gov/OST/fish/ for fish consumption advice and fish advisories nationwide and www.epa.gov/cleanwater/ for information on the Clean Water Plan. See www.epa.gov/oar/mercury.html for the mercury report, or order it from the National Technical Information Service (NTIS) for a cost of approximately $300.
- U.S. Fish and Wildlife Service's environmental contaminants program, http://www.fws.gov/r9dec/ecprog.html#.
- U.S. Geological Survey. Fact sheet, *Mercury Contamination of Aquatic Ecosystems*, FS-216-95. For documents, contact District Chief, USGS, Water Resources Division, 6417 Normandy Lane, Madison, Wisconsin 53719 (web site address: http://wwwdwimdn.er.usgs.gov/pubs/FS-216-95/index.html). See also fact sheet *San Francisco Bay Program: Lessons Learned for Managing Coastal Water Resources* (water.usgs.gov/public/wid/html/sfb.html). Contact: Chief, Branch of Regional Research, U.S. Geological Survey MS472, 345 Middlefield Road, Menlo Park, California 94025, (415) 329-4412.